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THE EFFECTS OF MAGNETIC STORM PHASES ON  
F-LAYER IRREGULARITIES  
FROM AURORAL TO EQUATORIAL LATITUDES

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## **COMPARISON OF F-LAYER IRREGULARITIES DURING PERIODS OF HIGH AND LOW SOLAR FLUX**

The latitude of the aurora (primarily of the E layer green line), shows only a one to two degree change as a function of sunspot number. An older paper by Starkov and Feldstein showed this small change in latitude (with magnetic index held constant and low) as a function of sunspot cycle. F-region irregularities, however, from our present study, show a great movement towards the polar region during years of low sunspot number (when keeping the magnetic index low). In order to predict the occurrence and level of the effects on trans-ionospheric propagation, the relationship to sunspot number of the high latitude irregularity region must be ascertained. We feel the comparison of high latitude data from Sweden and Canada that we have available will allow us to state that the poleward movement of the region during low sunspot years is a global phenomenon.

## **COLLABORATIVE STUDIES**

We have analyzed the data shared with us by Dr. Leonard Kersley of the University College of Aberystwyth and his group. Data from several periods of interest in the low sunspot years of 1985 and 1986 has been contoured. The data available included that from the University College of Wales data set taken in Kiruna, Sweden as well as other data taken in Goose Bay, Labrador and equatorial sites. Evaluation of data sets has included new analysis as well as the utilization of older data, much of it at this date more reduced.

## **MODEL EVALUATION**

In two excellent papers, researchers have attempted to ascribe the pattern of the occurrence of equatorial irregularities as due to either the declination of the stations or to maximum gradient of conductivity in the sunset time period. We have evaluated the observational basis which can be used to test these theoretical models. Satellite in-situ data, scintillation and spread F observations have been reviewed. A paper on the morphology of equatorial irregularities relative to their generation has been prepared by Jules Aarons for the AGARD Symposium on Radio Location Techniques to be held in London, UK 1-5 June 1992. The paper has been cleared thru ONR. The abstract follows:

### **ABSTRACT**

#### **THE LONGITUDINAL OCCURRENCE OF EQUATORIAL F LAYER IRREGULARITIES**

Determining the morphology of F layer irregularities as a function of longitude in the equatorial region is vital for understanding the physics of the development of these irregularities. We aim to lay the observational basis which then can be used to test theoretical models. Theoretical models have been developed, notably in the papers by R.T. Tsunoda (Rev. Geophys. 26, 719, 1988) and by T. Maruyama and N. Matuura (J. Geophys. Res. 89, 10903, 1984). The question is whether the models are consistent with the morphology as we see it. According to our criteria, the data used should be confined to observations taken near the magnetic equator during quiet magnetic periods and at times within a few hours after sunset. Anomaly region data should be omitted for studying the generation mechanism. The questions to be answered by proposed mechanisms are (1) why do the equinox months

have high levels of occurrence over all longitudes? (2) why are there relatively high levels of occurrence in the Central Pacific Sector in the July-August period and in the 0-75° West Sector in the November-December period? (3) why are there very low levels of occurrence in November and December in the Central Pacific Sector and in July and August in the 0-75° West Sector? Satellite in-situ data, scintillation and spread F observations will be reviewed. The limitation of each data set will be outlined particularly as relevant to the bias produced by the existence of thin versus extended layers of irregularities. A cartoon as to the occurrence pattern, as we see it, as a function of longitude will be shown.

## JOURNAL PAPER

The paper entitled Onset Conditions for Equatorial Spread-F by Michael Mendillo, Jeffrey Baumgardner, Xiaoqing Pi, Peter J. Sultan of the Center for Space Physics and by Roland Tsunoda of SRI International has been accepted by the Journal of Geophysical Research.

## ABSTRACT

### ONSET CONDITIONS FOR EQUATORIAL SPREAD-F

The problem of day-to-day variability in the occurrence of equatorial spread-F (ESF) is addressed using multi-diagnostic observations and semi-empirical modeling. The observational results are derived from a two-night case study of ESF onset conditions observed at Kwajalein Atoll (Marshall Islands) using the ALTAIR incoherent scatter radar and all-sky optical imaging techniques. The major difference between nights when ESF instabilities did not occur (14 August 1988) and did occur (15 August 1988) in the Kwajalein sector was that the northern meridional gradient of 6300Å airglow was reduced on the night of limited ESF activity. Modeling results suggest that this unusual airglow pattern is due to equatorward neutral winds. Previous researchers have shown that trans-equatorial thermospheric winds can exert a control over ESF seasonal and longitudinal occurrence patterns by inhibiting Rayleigh-Taylor instability growth rates. We present evidence to suggest that this picture can be extended to far shorter time scales, namely, that "surges" in trans-equatorial winds acting over characteristic times of a few hours to a day can result in a stabilizing influence upon irregularity growth rates. The seemingly capricious nature of ESF onset may thus be controlled, in part, by the inherent variability of low latitude thermospheric winds.



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